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HOW TO BUILD A PRACTICAL SPEED PHOTOFLASH OUTFIT

By W. G. MANY, Editor, C-D Capacitor

Since several types of speed flash lamps or tubes are available, considerable interest in speed photography and equipment has been in evidence among radio men and amateur photographers. Mr. John S. Carroll described the underlying principles of these tubes and circuits in which they are used in "Electrical Manufacturing" as reviewed in the preceding issues of the C-D Capacitor.

In this article we shall give our readers constructional data on a semi-portable photoflash outfit which is practically suited for any general indoor work along the lines of candid group shots, child portraiture, medical, scientific, technical, or sports subjects, where it is desired to "stop" fast moving or high-speed action. The equipment shown in the illustrations is easily constructed from standard components obtainable from most any radio parts supply distributor and consists of two principal units, a power supply and flash gun. The power supply unit and two Cornell-Dubilier Type HKGT, 25 mfd., 2,000 volt photoflash storage capacitors are contained in a wood cabinet 9¾" x 10½" x 13¼" which is provided with a carrying handle and 15 feet of power line cord, making it possible to be conveniently carried to

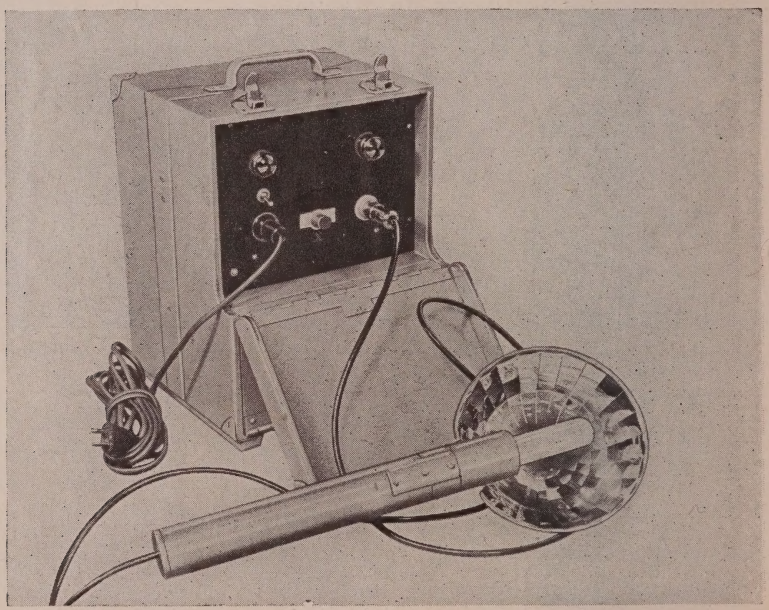
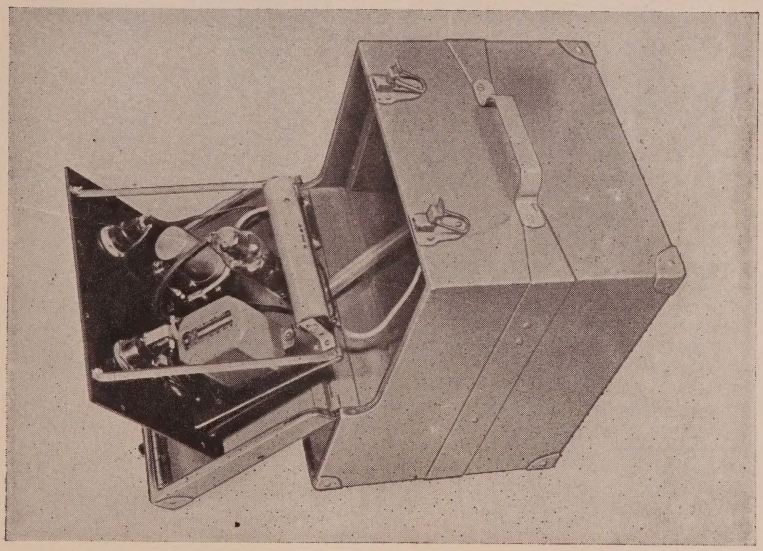


Photo showing the complete photoflash outfit consisting of a power supply in the cabinet and the auxiliary triggering circuit and flash tube in the flash gun handle.

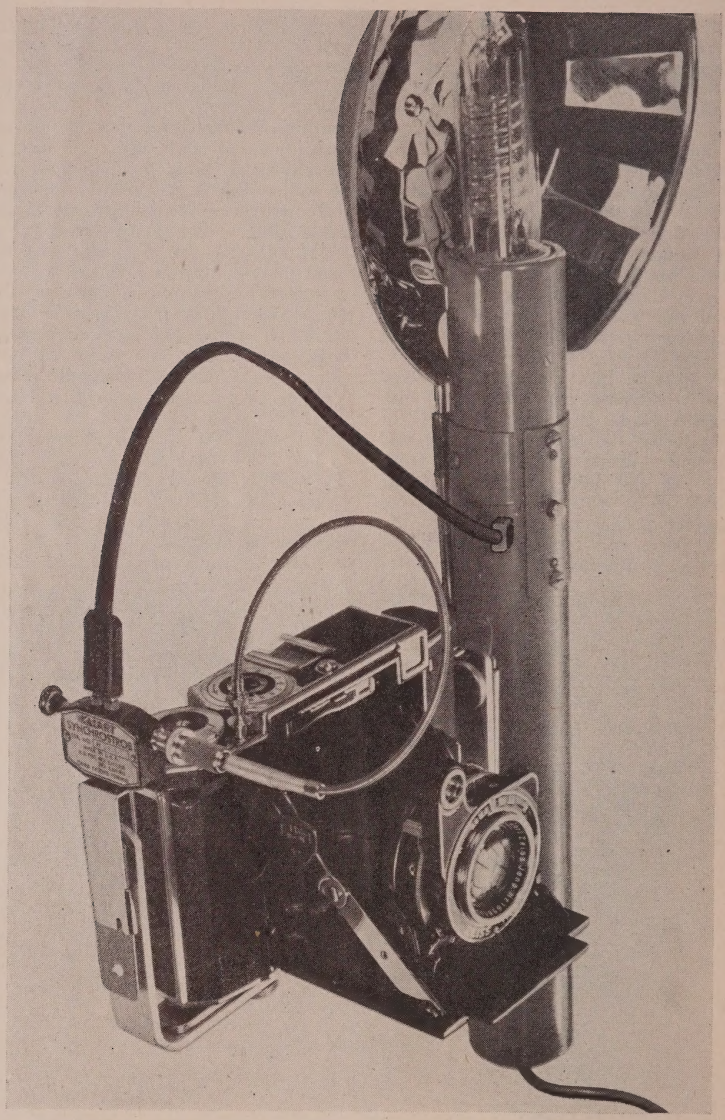
any location within an average size room in the home. The cabinet can either be made to suit the fancy of the constructor or one of many types of standard instrument cabinets may be used. The writer found the one shown in the photos at a war surplus store, costing a few dollars. It was designed for an army frequency calibration meter. A heavy waterproofing canvas duck covering with snap fasteners was removed and holes filled with plastic wood and putty, then repainted in grey lacquer. Other unnecessary metal and wood parts inside the compartments were also removed before painting.

A bakelite front panel 7¼" x 9$\frac{13}{16}$" with a sub-base panel attached with brackets made mounting facilities for components shown in the photos and schematic diagram. On the front panel at the left may be seen the 115 v. A.C. pilot light, switch, and plug receptacle, and at the right the neon pilot, and coaxial connector for the lead to the gun. In the center of the panel is a heavy duty push-button switch which shorts the storage capacitors through a 100 ohm 100 watt resistor for safety' sake in the event the unit is removed from the cabinet or the high voltage leads touched for any reason shortly after use. In fact, as an additional safety precaution, it may be well to get in the habit of pushing this switch immediately after the power line switch is thrown off. A slight snap of the discharge and the neon pilot going out indicates that the capacitors are properly discharged. Too much caution is not amiss on this score. It is also suggested to paint in large letters with red paint on both sides of the cabinet **Danger! High Voltage** as a caution against accidents to those who may like to inspect things while the outfit is in operation.

The 2,200 volts A.C. from a U.T.C. Type PT1 photoflash transformer is rectified through a 2 x 2/879 tube to charge the storage capacitors. The transformer also has a 2.75 v., 1.75 a. tap for the heater of the rectifier tube.



The power unit with the front panel removed to show the arrangement of parts on the sub-panel. Two leads connect from power unit to storage capacitors.



A close-up of the flash gun showing the camera mounting bracket, reflector and synchronizer assembly. The push-button on the handle is the manual trip switch while the cable release synchronizer operates both shutter and flash simultaneously.

The common open-flash-shut method of exposure may be employed by means of manual trip-switch control.

A 100 ohm, 100 watt, wire-wound current limiting resistor is mounted on the rear of the sub-panel while a series of six carbon resistors, employed as a power supply bleeder, are mounted beneath the sub-panel where connections are also made to an inverted can type 2 mfd., 2,000 volt capacitor. The rest of the layout and wiring of parts on the front and sub-panels are clearly shown in the accompanying photos and wiring diagram.

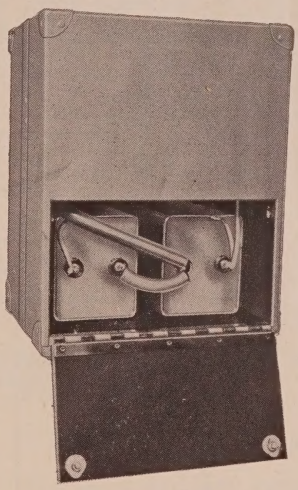
The Flash Gun and Triggering Circuit

The pros and cons on circuits employing relays with open-end spiral self-ionizing tubes versus that of an auxiliary triggering circuit method using a closed spiral tube has been already treated elsewhere. The writer has a personal preference for the auxiliary triggering circuit method based on experience with high speed photo-flash equipment since the early days of Dr. Harold E. Edgerton's early experiments, and thus, suffice it to say, in deciding to build this outfit chose to employ the relay tube control triggering method in conjunction with a Kalart "Synchrostrob" instantaneous synchronizer as shown in the accompanying photo. Furthermore, the new Sylvania miniature OA5 trigger tube proved ideal for mounting in the handle of the gun and reduces time delay in switching, deionization time, and possibility of shock. Firing may therefore be controlled either by most any of the built-in synchronizing switches as provided on modern cameras, or by a manual trip-switch mounted in the handle of the gun using the "Open-Flash-Shut" method. The writer improvised a neat little manual trip switch from a tiny G.E. flex switch in a bakelite casing.

A small standard minature plug receptacle is mounted close to the manual trip switch in one side of the handle to make connection with a short length of flexible double conductor cord from the gun to the synchronizer.

A heavy steel bracket bent on an angle was made to mount the gun to the camera. Knurled thumb-screws in the camera tripod mounting hole and a fitting on one side of the gun makes the camera and gun readily detachable.

The handle of the gun is made from a length of heavy bakelite tubing 13" long by 1⅜" I.D.



The two 25 mfd. storage capacitors are mounted in the lower compartment in the back of the cabinet.

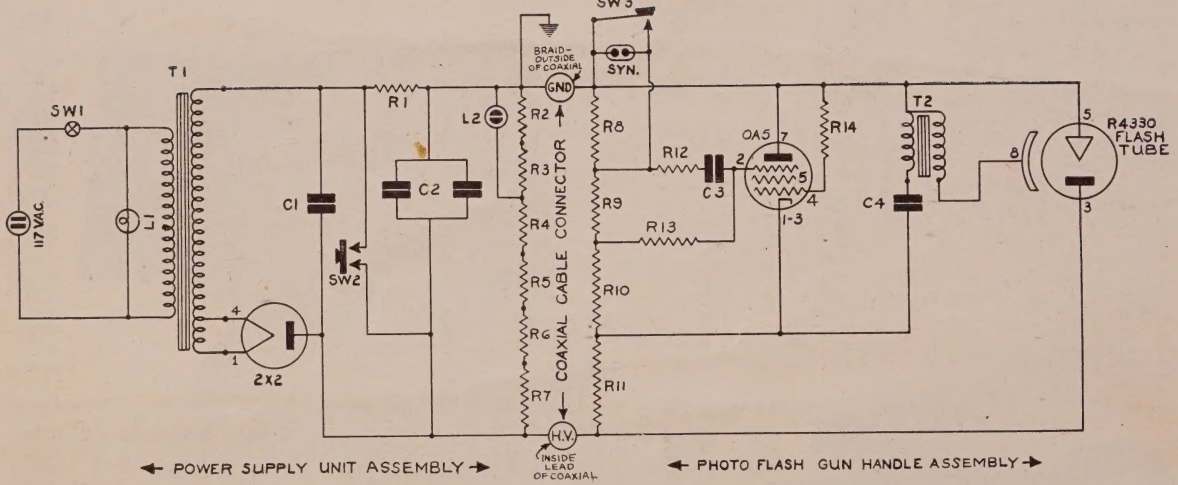


Fig. 1. Wiring diagram of the power supply unit and trigger circuit.

C1—2 mfd. 2,000 v. capacitor, Cornell-Dubilier Type TQ 20020.
C2—Two 25 mfd. 2,000 v. photoflash storage capacitors, Cornell-Dubilier Type HKGT 101.
C3—.01 mfd. capacitor, Cornell-Dubilier Type DT 4S1.
C4—.25 mfd. capacitor Cornell-Dubilier Type DT 4P25.
R1—100 ohms, 100 watt wire wound resistor.
R2, R3, R4, R5, R6—Five 200,000 ohm insulated carbon resistors connected in series.
R7—4 meg. insulated carbon resistor.
R8—170,000 ohm insulated carbon resistor.
R9—¾ meg. insulated carbon resistor.
R10—180,000 ohm insulated carbon resistor.
R11—3.2 meg. insulated carbon resistor.
R12—¼ meg. insulated carbon resistor.
R13—10 meg. insulated carbon resistor.
R14—20 meg. insulated carbon resistor.
SW1—Panel mounting type toggle switch.
SW2—Spring push-button switch, 220 v. insulated type.
SW3—Manual trip switch, G. E. miniature push-button.
SYN—Miniature plug receptacle for synchronizer.
T1—Transformer, United Transformer Corp., Type PF-1.
T2—Ignition transformer, Sec. 15,000 v. or more, model aeroplane type spark coil.
L1—117 v. A.C. pilot light.
L2—Neon pilot light.

All parts as shown in the illustration Fig. 2 and wiring diagram, Fig. 1, were mounted with Du Pont Household Cement in a piece of bakelite tubing 1⅜" O.D. 1/16" thick which was cut in half lengthwise to fit inside the tube handle.

Seven ½-watt moulded bakelite insulated carbon resistors, spark coil (model aeroplane motor ignition coil), and tubular paper capacitors, miniature socket, and Sylvania OA5 triggertube are mounted in this shell or half piece of bakelite tubing, wiring is made with light polystyrene covered stranded copper wire, keeping high voltage leads well separated from ground and other leads. A seven foot length of single conductor and copper braid coaxial cable with polystyrene insulation which will withstand over 2,000 volts is brought out through a hole made off to one side in a bakelite disc cover at the bottom of the handle, see Fig. 2.

The socket for the Sylvania Type 4330 flash tube was made from an Amphenol octal base voltage safety socket with the upper molded shell cut off and the unused pin connectors removed. The tube handle is then bored out at the end on a lathe to fit the socket loosely and drilled through at opposite sides and tapped for two small flat-head machine screws to hold the socket firmly in place. The connections to the synchronizer plug receptacle and manual trip-switch are soldered to leads brought through mortises cut in the upper part of the bakelite tube handle and mounted with small screws. The entire assembly can be easily inserted into the flashtube end of the handle after being assembled and wired. An Amphenol 93-series single conductor coaxial connector is finally connected at the end of the coaxial lead ready to be inserted into the companion connector on the panel of the power supply unit. A standard adjustable reflector made for flashbulb guns as shown in the photos is one of highly polished 7-inch types available at any photo supply house. A reflector mounting band fitted three-quarters around the gun handle can easily be made from sheet brass and mounted with two small machine screws.

Synchronizers

The miniature receptacle and short flexible cord with plug shunt across the manual trip switch provides a convenient means of connecting to different types of synchronizers of either the built-in shutter variety or an auxiliary switching device. Since the flash takes but 1/5000 of a second it is important to have perfect synchronization between the flash and the opening of the camera shutter. Synchronizing with cameras which have fixed built-in synchronizers rarely requires adjustment.

Among the auxiliary instantaneous types of synchronizer switches avail-

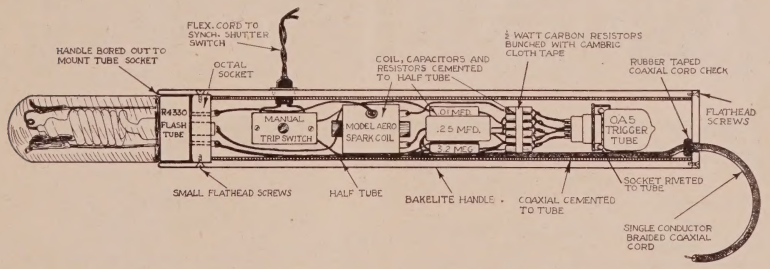


Fig. 2. Sketch showing the flash gun construction and layout of parts in the bakelite tube handle. By removing the two screws in the octal socket and connections to the manual trip switch the entire assembly mounted in the half tube can be readily removed for inspection. Care must be taken to have high voltage leads well insulated and separated from ground and spark coil leads in order to prevent flash-overs.

able through most of the larger photo supply dealers for use on cameras which are not provided with built-in synchronizers are the lensboard mounting type, and cable release type as shown on the camera in the photo herewith. The latter can be used on almost any make of camera provided with a set-and-release type shutter.

Those who obtain an auxiliary synchronous switching device will be given instructions for synchronizing it with their particular camera shutter, or most dealers will have it done for a small charge. Because of variations in shutter opening time when the fastest shutter speeds are used, it is recommended that 1/100 second (or slower) shutter speed be used when synchronizing with an auxiliary device.

In operating the unit the storage capacitors charge quickly but it is best to allow about 15 seconds between flashes to assure time for the capacitors to charge fully. A weak flash or none at all will otherwise result in a poorly exposed negative or blank.

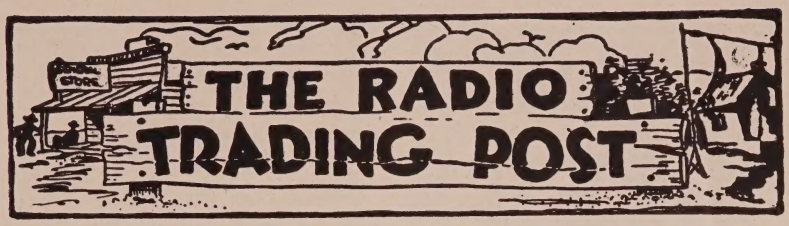
The manufacturer's rated light output of the flashtube is approximately 12,000,000 lumens. Therefore, a comparison of shutter openings at a distance of 10 feet at 1/400 of a second is as follows:

A better attempt could of course have been made to build the power supply unit in a more compact assembly and smaller cabinet in order to be lighter in weight and less cumbersome in handling. However, the writer's original intention was to arrange a battery-power pack supply using small war surplus storage batteries in the lower compartment of the cabinet shown with the storage capacitors in the rear of the upper compartment behind the high voltage supply panel. But, after considering the advantages of a battery powered unit compared with the additional weight involved, the trouble of battery recharging, etc., it was decided that a 115 v. A.C. operated unit would meet most general indoor needs where A.C. outlets are usually convenient. Nevertheless, this semi-portable unit, with 50 mfds. of storage capacitance, gives sufficient light output for general indoor subjects. It also serves as a springboard for the constructor's ingenuity and design ability to build a power supply unit suited to his own liking, being sure, however, to employ capacitors and other components which are safely rated against breakdown in the equipment.

Photoflash and Flash Bulbs	Film Speed (Weston-Tungsten Ratings) 16	32	64	125
Photoflash	f6.5	f9	f12	f18
Press 25	f6.5	f9	f13	f18
No. 0	f5	f7.5	f11.5	f14
Press 40	f6	f9	f14	f20

To get the "f" number of the shutter opening divide the number given for your film speed and flash bulb by the distance in feet between the subject and flash bulb.

Photoflash and Flash Bulbs	Shutter Speed	Film Speed (Weston-Tungsten Ratings) 16	32	64	125
Photoflash	ANY	65	90	120	180
Press 25	1/400	65	90	130	180
No. 0	1/400	50	75	115	140
Press 40	1/400	60	90	140	200



A Free Market-Place for Buyers, Sellers, and Swappers.

These advertisements are listed FREE of charge to C-D readers so if there is anything you would like to buy or sell, if you wish to obtain a position or if you have a position to offer to C-D readers, just send in your ad.

These columns are open only to those who have a legitimate, WANTED, SELL or SWAP proposition to offer. The Cornell-Dubilier Electric Corp. reserves the right to edit advertisements submitted, and to refuse to run any which may be considered unsuitable. We shall endeavor to restrict the ads to legitimate offers but cannot assume any responsibility for the transaction involved.

Please limit your ad to a maximum of 40 words, including name and address. Advertisements will be run as promptly as space limitations permit.

SWAP—Small V.O. meter, model 720 Technical Apparatus Co., Vibroplex "Original" speed bug perfect condition. Tobe condenser analyzer, model 1496. Urgently need model CC-1-60 Solar condenser analyzer, complete. A. Diedricksen, 11 Vine St., New Britain, Conn.

POSITION WANTED—Radio service student at Cass Tech, graduating in June, wishes employment as apprentice in a Detroit shop. Am familiar with service equipment and own a signal tracer and VOM. Robert Klepazyk, 20029 Spencer Ave., Detroit 12, Mich.

FOR SALE—"Electrical Engineering" AIEE magazines, April, 1940 to October, 1943. Solid gold AIEE maroon watch charm key. Society American Militar Engineers magazines, September, 1940 to September, 1943, and solid gold watch charm. Write offer. Need 16mm movie outfit. ART-13 transmitter. D. J. McLaughlin, 1720 W St., S.E., Washington 20, D. C.

WANTED—April 1944 Radio News magazine intact. Will swap for other issues of same magazine or Radio Craft or will pay cash. Also a good signal generator. Will swap for whatever you need or pay cash. Peter Shavel, 941 Grand St., Brooklyn 6, N. Y.

VETERAN, radio television construction repairs, formerly NBC-RCA, desires position opportunity for advancement if justified, samples of construction, willing to place myself in your hands on basis fair to us both. Ernest D. Clark, 1090 Simpson St., New York 59, N. Y.

FOR SALE—Admiral radio service manual, new, $2. Philco model 088 all wave signal generator, $18. Triplett tube tester, model 1185, $20. All are guaranteed in perfect condition. Victor Kozma, 3104 Wilkinson Ave.,. New York 61, N. Y.

FOR SALE—NRI course, QST's back to 1939, 2 meter transreceiver in metal cabinet, ideal for mobile, many other rigs, receivers, and parts. Write for list. Alfred Freitag, 1437 Patapsco St., Baltimore 30, Md.

WILL TRADE—Philco auto radio model in A1 condition, like new. Manual and push button tuning, under dash panel mounting in any position, 7 tube superhet, detachable speaker, a real bargain: Trade for signal generator or signal tracer or VT volt ohm meter or condenser tester, 0001 to 16 mfd, VT ohm meter read 0 to 10 meg. Prefer to trade for signal tracer or signal generator. Will answer all letters. Wire collect. Barton's Midget Radio Service, 2765 E. 79 St., Cleveland 4, Ohio.

FOR SALE — Jensen A-12 high fidelity speaer, 14 watts, 250 ohm field, perfect condition. 8 ohm VC 12" size, $12 FOB Chicago. Paul H. Prokes, 9216 S. Menard Ave., Oak Lawn, Ill.

FOR SALE—Used radios all makes. Majestic dynamic speakers. Transformers, A eliminators, Trickle chargers, B eliminators. Want 3¼ and larger dc milliampere 0-100 mills, must be brand new and perfect meters. Send postage for bulletin. Louis A. Goldstone. 1279 Sheridan Ave., Bronx 56, N. Y.

FOR SALE—Radio tubes, all makes, all types at 35% to 45% off list price. Discount varies depending on quantity purchased as per latest OPA schedule. All tubes guaranteed or money back. V. Kozma, 3104 Wilkinson Ave., New York 61, N. Y.

FOR SALE—First $50 money order takes Kodak Monitor 616 with 4.5F lens, Eveready case, DeJur pocket range finder, sunshade. All in excellent condition. Shipped prepaid express. J. Flutiso, 1837 Hunt Ave., New York 60, N. Y.

FOR SALE—Precision E-200 signal generator. Brand new, never used. Reason for selling, going out of business. Cost $65.43. First money order for $58 takes it. Milton Maultasch, 535 Grand St., Brooklyn 11, N. Y.

WANTED — Radio and electronic equipment and parts. Must be in good operating condition. Write giving full description, make, model, and minimum cash price. R. L. Edwards, Jr., 1605 Irving St., N. W., Washington 10, D. C.

FOR SALE—National high frequency short wave receiver, type NC100A, 10 tube with Jensen speaker and head phones. Best offer takes it. Bernard Godlewski, 16½ Depot St., Greensburg, Pa.

FOR SALE—Electric neon sign "Radio." Has neon border and lightning flash. Letters eight inches high, heavy duty transformer. A1 condition, $35 FOB. Carr Electric Products Co., 15-17 Kelley Sq., Worcester 4, Mass.

FOR SALE—Miller Exciter with tubes, 10 meter, coils, $35. S-40 Hallicrafters 4 months old, $75. 2000 volt 500 ma power supply, rack mounting, variable primary plate transformers, 1 803, 1 211H, 1 832, 1 808. H. Browne, 1709 W. 10th St., Brooklyn 23, N. Y.

SELL OR SWAP—New Springfield .22 combination automatic and repeating rifle, model 87, cost $23.50, selling $21.50 postpaid. I am interested in dc to ac inverters, 110 volts 100 or 75 watts. John May, Box 169, Canal Station, New York, N. Y.

FOR SALE—Brand new approved model A-100 signal generator, $42. Triplett model 3212 counter type tube tester, $49. Equipment in perfect condition and hardly used. Leo Raboy, 1801 Longfellow Ave., Bronx 60, N. Y.

FOR SALE—New Hallicrafters SX-36 receiver, AM-FM-CW, tunes 27 to 150 mc amateur band. Regular $307. Special for quick sale, $212. T. D. Smith, Rt. 3, Box 76, Vancouver, Wash.

WILL SWAP—One model 1B-8 University booster speaker 8 ohm 12 watt, new, for volume one of "Sam's Photofact Service" or what have you to offer in service equipment. Stan's Radio Repair, G6051 Myrtle Ct., Flint 7, Mich.

FOR SALE OR TRADE—Dozen of the following tubes: 12SK7, 12SR7, 12K8, 1629, 12A6, VR-150-30. Need several 6SK7, 6SQ7 or what have you? A. L. Oliviera, 94 Potomska St., New Bedford, Mass.

SALE OR TRADE—Columbia rotary converter dc to ac, dc 115v 1.6 amps, ac 87v 100 watts. Used but in good condition, $5 or signal generator, any condition. A. F. Krupinski, Star Rt., Webster, Mass.

WANTED—Tubes, 25B8, 12B8, 25A7, 1B5, 1E4, 1F6, 1F7, 1G5, 2A7, 2A5, 12B6, 35-51, 58, 1D8, 1LA4, 1LE3, 2A3, 6AC5, 6F5, 6SF5, 6K5, 25A6, 25AC5, 25B6, 35Z6, 50Z7, 117Z4. Only new cartoned tubes wanted, send price. quantity and brand. L. Greene, 9 Eliot, Watertown, Mass.

FOR SALE—New Army signal generators, model 198-A ac operated 7 to 15mc fundamentals, 400 cycle mod. CW. Ideal for FM and television alignment or as a ECO, complete with instructions, $12.95. Can easily be converted to cover broadcast band. Can supply any amount needed. Bazan's Radio-Television, 1000 Van Nest Ave., Bronx, N. Y.

FOR SALE OR SWAP—Radio course ICS, Supreme mostly used diagrams, 1928-1938, and 1939. First four sets of photofacts diagrams. A. Blanchard, 5 Cedar St., Waltham, Mass.

FOR SALE—Rider service manuals, 1 to 11 inclusive. Jackson 634 tube tester. Hickok 0S10 signal generator. Solar CB 1-60 capacitor analyzer. Admiral record changer. Many Rider publications. All or part. R. B. Brown, 1363 Duncan Ave., Los Angeles 22, Calif.

ATTENTION — Am organizing radio club in New York and want more out of town members from all states and Canada. No dues! Only requirement is true interest. Send name and age to Jerome Hamerling, 1562 Vyse Ave., New York 60, N. Y.

FOR SALE—11 9003 (or VT-203) radio tubes (Ken-Rad) and adapters for 50L6, 35L6. Will accept first $5 money order. Williamson Radio Service, Cooper, Tex.

WANTED—Sparx signal tracer. Have to trade portable radio, speakers, tubes, also many gift items. Send for list. G. Samkofsky, 527 Bedford Ave., Brooklyn 11, N. Y.

FOR SALE—Stancor 112T transceiver in perfect condition. New tubes HY75, 6J5, 6V6, no power supply. Price $30 FOB. William J. Reinstodler, 531 River St., Scranton, Pa.

FOR SALE—Special offers on magazine subscriptions. 1 year to Esquire for $5, regular rate is $6. Offer expires June 30; 25 months to Reader's Digest only $5. You save $1.25 on single copy price. Offer expires July 25, 1947. Try me also for those hard to get radio tubes. Fred Geyer, 2447 Cortland St., Chicago 47, Ill.

FOR SALE—Frequency meter I-140A Signal Corps type, less micro ammeter. Has 3 coaxial sockets and tuning unit with microammeter adjustment. In metal box 3⅝x2⅝x9. E. Freeland, 4832½ W. Madison St., Chicago 44, Ill.

FOR SALE—High quality IRC gold band and silver band resistors, assorted resistance values, 75 for $1. This is fine value. S. S. Schlissel, Box 10, Kingsbridge Sta., New York 63, N. Y.

FOR SALE—Hallicraft Skyrider Jr., model S41G. Used about 30 hours. First $30 takes it, express charges collect. Charles E. Keinath, 38 Prospect St., Newark, Ohio.

FOR SALE—Radio shop with complete modern equipment, located in the best part of the U. S. in a town of 3,000 plus population. One other shop in town. reason for selling, ill health. Make offer. B. E. Electric and Radio Shop, 114 E. 4th St., Blue Earth, Minn.

FOR SALE—Radio and electrical appliance sales and repair store. Tubes, parts, supplies, test equipment, and radio books. Price very reasonable. Low rent, good opportunity. A. Wiener, 494 Crescent St., Brooklyn, N. Y.

FOR SALE—Brand new 1947 Precision 856 multi-range tester 1200v to 6000v ranges built especially for television, also 7 voltage ac and dc ranges, 3 resistance, 6 decibel, 7 output ranges. Hi voltage test probes, walnut carrying case, and full instructions. Advertised for $47.50, will let go for $40. Bill Graham, 66-24 Forest Ave., Brooklyn 27, N. Y.

FOR SALE—Radio tubes at 20% off list. New, in cartons, postpaid. One or more of each. Send for list. C. C. Butler, 616 E. 5th, Cherryvale, Kans.

FOR SALE—APS radar system, X band 35 kw, with spare components. H. E. Branher, 155-01 90th Ave., Jamaica 2, N. Y.

FOR SALE—New television receivers, 7'', assembled from kits, $195. Guaranteed. Reisman Television Laboratories, 319 Canal St., New York 13, N. Y.

WANTED—Instruction manual for radio transmitter BC191. Am willing to give fair price for same. Raymond R. Bohnert 373 S. Second St., Medford, Wis.

FOR SALE—Brand new surplus resistors, 150 ohm at 10 watts, wire wound with lugs, vitreous enameled. Made by Ward Leonard. 12 cents a piece. Supply limited. Sidney Lebowitz, 143 Branford St., Hartford 5, Conn.

WANTED—S20-R, S19-R. Will buy for cash or trade ½V.P. German make camera, F2.9 lens, 1-175 shutter. Would like to purchase old Browning 35 receiver. M. H. Stark, 119-22 180 St., St. Albans 12, Long Island, N. Y.

FOR SALE OR TRADE—CW3 fixed tuned receiver, TBY transmitter and receiver with battery vibrator pack, BC221AK frequency meter, pair of 803's. Want modern tube checker, lateral vertical pickup, Reflex speaker, oscilloscope. S. Mayo, 372 E 16 St., Brooklyn 26, N. Y.

SWAP—Have NRI radio television course. Want camera. Luther Hoffman, 678 Princeton St., Palmerton, Pa.

FOR SALE OR TRADE—35mm Mercury II-2.7 lens, like new. Trade for Perfex 55, Argus C3, or multitester. R. Rudofsky, 433 Herzl St., Brooklyn 12, N. Y.

FOR SALE—50 watt phone and CW transmitter $150. 60 watt phone and CW transmitter with ECO $200. Speco signal tracer, new, $25. 125 watt modulation transformer $8. RME45 receiver, latest model, $150. 811 tubes $2 each. 866 Jr. 75 cents each. 50 ohm coax cable, 50 feet, $3. S38 Hallicrafter receiver, new, $40. Write for list of other parts. Walter Keith Radio Sales and Service, 201 W. 2nd St., North Newton, Iowa.

FOR SALE—Philco auto radio model 920, in good condition, $25. Philco schematics of early radio models, from model 3 to model 511. Motorola 1942 home radio diagrams. Gernsback's 1936 radio diagrams. Price for all set $4 plus postage. James Domino, 58-81 Maspeth Ave., Maspeth, N. Y.

WANTED—Ex-GI with 3 years experience on xmitters and receivers desires position as radio repairman or operator for any position requiring 2nd class phone license. Possess 2nd class license. Clinton J. Lewis, 82 Broadway, Bel Air, Md.

SELL OR SWAP—50 even speed 78 rpm phono motors and turntables, $2.25 each or what have you? Dynamic Radio Lab., 489 Graham Ave., Brooklyn 22, N. Y.

FOR SALE—Signal generator, approved model A-200, frequency 100kc to 75mc. Complete with operating instructions and two test leads for $38.50. H. S. Stempel, 3 Spruce St., Doylestown, Pa.

WANTED—Power supply to deliver 90v B and 3v A for battery radio, from 110v ac. A. D. Reid Radio Service, 271 4th Ave., Stratford, Conn.

FOR SALE — Electric Hawaiian guitar, complete with 4 watt amplifier. New looking, used only about 3 months. First money order or check for $35 takes it. No C.O.D. Charles Buskirk, 189 N. Graham, Martinsville, Ind.

FOR SALE—9"x6"x5" 3 tube battery receiver, tunes 1.5 to 16 mc. Plenty bandspread. Batteries, extra coils fit in cabinet. Complete tubes and batteries but less phones, $15. J. Marquez, Box QQ, Hobbs, N. M.

WANTED—Recording head and arm preferably home recorder, or if overhead cutting, head complete with gear and motor. E. R. Mussbaumer, 48 Hock St., W. Moose Jaw, Saskatchewan, Canada.

SELL OR TRADE—Hickok 210X Jumbo 9", infinity ohms per volt meter. Need signal generator or tubes. Write for details. E. Sujak, 4209 Elston Ave., Chicago 18, Ill.

FOR TRADE—Green flyer phono motor and pickup, and Triplett set tester, model 1501. Needs a little work on it. Meter OK. Also have Supreme model 85 tube checker in fair shape. Want good signal generator. W. L. Anderson, 144 Exchange St., Rockland, Mass.

FOR SALE—Back issues of Popular Science, complete from April, 1944 to July, 1946. Also September to December, 1946. Assorted before April, 1944. Also assorted issues of Popular Mechanics, and Science and Mechancis, October, 1941 to Dec, 1944. George Greenfield, 7101 Bay Parkway, Brooklyn 4, N. Y.

FOR SALE—A complete radio demonstration course consisting of 6 kits of radio parts and equipment, 6 manuals of instructions, everything new. Practical testing instrument, battery included. Vaucum tube power pack. Amplitude modulating signal generator. Frequency modulating signal generator. 5 tube superhetrodyne receiver, tubes included. Soldering iron and wire. $25 takes all. William Graham, 66-24 Forest Ave., Brooklyn 27, N. Y.

FOR SALE — Portable automatic record changer in leather case, with phono osc., built in. Plays through any radio. Plays 10 12" or 12 10" records. Price $15. M. Francis, 1232 E. 75th St., Chicago 19, Ill.

POSITION WANTED—Young man, 19, desires full-time position as radio serviceman or helper in established radio shop, vicinity Brooklyn or New York City. Am student of the National Radio Institute and have had 2 years experience servicing radios. I am also familiar with all types of test equipment. Ernest J. Bottcher, 136 E. 28th St., Brooklyn 26, N. Y.

FOR SALE—BC375 xmitter partially complete, less tubes, meters and tuning units, $9. Also Hetrodyne Frequency meter, $7.50; 10 meter xtal, $4.50. Cash or what have you? Need movie projector. Frank H. Carlson, New London, Iowa.

FOR SALE OR TRADE—Weston test equipment. LN analyzer 774 type 4 complete with tube checker circuit adapters and instructions. Measures ac, dc current and capacity; 100 micro amp 4" meter; model 564 pocket voltohmmeter and model 571 pocket output meter. Will trade for camera. D. Ashepa, 1950 Andrews Ave., Bronx 53, N. Y.

FOR SALE OR TRADE—Complete course in storage battery rebuilding. Price $8. Elmer A. Zieroth, Main St., Durham Center, Conn.

SALE—New Navy RAK-7 low frequency receiver, power supply, tubes, original packing case, $57. RCP multitester, model 414, perfect, $30. Both prepaid. Also over 200 size 15-20 watch movements, Waltham, Hamilton, Elgin, Swiss, etc., 50 cents apiece. W. D. Beal, Chestnut Hill, Mass.

WANTED—Transformer for Crosley model 170 radio; state your price and condition. It is a 60 cycle, 110 volt, the set applies 10 tubes. Howard's Radio Service, 42 Maple Avenue, Fords, N. J.

SELL OR SWAP—Have practically new National NC-44 receiver, separate speaker and earphones. Will sell for best offer or swap for adding machine which is badly needed. Sylvan Sweets, 606 Northampton St., Easton, Pa.

FOR SALE — Supreme-Beitman manuals, complete set, 1926 to 1942, $8 postpaid. Ghirardi's "Radio Physic's Course" book $3.50 postpaid. Winchester model 06, .22 caliber rifle, guaranteed like new, nearly new barrel, newly blued by factory method, $25 postpaid. Rider's 1-5 and volume 10, both new, $30 postpaid. Want Rider's "Servicing by Signal Tracing." Jack Marley, Bedford, Iowa.

WILL SWAP—Ghirardi's Radio Physics Course, Modern Radio Servicing, Radio Trouble Handbook, and Army Airways Communications Mechanics Handbooks for good used short wave receiver, preferably Hallicrafters. Books are in new condition. Pat Scognanilio, 361 11th St., Brooklyn 15 N. Y.

FOR SALE—Globe-smashing specials. All types of tubes 60%-80% off, new, in cartons, guaranteed 90 days. ½ meg. volume controls 2" shaft, SPST switch, 47 cents; DPST switch, 58 cents. 5" Alnico No. 5 PM speaker, 1 oz. magnet, $1.45. Write for free parts catalog. Globe Distributors, 72 Harvard St., Boston 24, Mass.

WANTED—Radio News magazines from July, 1946 to May, 1947, with the RN Circuit File still in them. Will pay cash or trade a rubber stamp or 13 copies Craft magazines for same. Cookson, Lock Box O, Puxico, Mo.

FOR SALE—1947 Seeburg 2 post record changer. Capacity 14 records. Brand new in original carton, $38.50. $10 down, balance C.O.D. 1 new American Beauty 200 watt soldering iron, $6.85. Klein 6" longnose pliers, $2.35 each. M. A. Porter, 1709 N. Larrabee St., Chicago 14, Ill.

SALE OR TRADE—2 Precision instruments. 1 dynamic electronometer, series 910 tube checker. Signal generator series E-200. Also Solar capacitor analyzer, CB model. Will trade for set of Rider Manuals. Metaire Radio Service, 321 E. Main St., Walla Walla, Wis.

FOR SALE—Eastman Vigilant Six-20 camera, anastigmat f4.5 lens, No. 1 supermatic shutter with speeds up to 1-400 second. Leather case. 3 filters and holder. General Electric exposure meter. All in perfect condition. Cost over $100. First money order for $55 takes all. Write for further details. Clyde W. Wimer, 800 Wampum Ave., Ellwood City, Pa.

WANTED—Rider's manuals 9-14 inclusive. Please state price and condition of books. All letters answered. Address to Mike's Radio Shop, Box 1315 Keewatin, Minn.

WANTED—1939 or later, good used radio service books by Hicks, Simon, Moyer and Wostrel, Ghirardi, Rider, and RCA Designers Handbook. Good used recent model National SW3. James Bezoti, 2732 Salina, Dearborn, Mich.

WANTED—Four, five or six tube high fidelity tuner for use with a high fidelity amplifier, preferably with own power supply. Frank W. Jones, Gabbs, Nev.

FOR SALE OR TRADE—Supreme radio diagrams volumes I through V; Audel's new Radioman's Guide, all issues of Radio News from May, 1944 through January, 1947. Also Dyke's Auto and Gas Engine Ency., 19th edition. All like new. Edwin O. Butgereit, 2118 S. 8th St., Sheboygan, Wis.

FOR SALE—Overstocked items. 70 plastic IF transformers, 455kc doubled-tuned 45 cents each, 19 Carron 4" and 5" speaker cones in original boxes 48 cents each. All brand new stock, will sell in part. Paramount Radio Service, 313 E. Market St., Wilkes-Barre, Pa.

FOR SALE—Univex movie projector model PC-10, new in original carton, 8mm. Postpaid for $35. Electric motor driven. H. Ursillo, 693 N. Broadway, E. Providence, R. I.

WILL SWAP—Meters, 0-1ma, 0-500 amp, ac, ammeters and voltmeters, Weston, Triplett, etc., Precision WW resistors, and other radio equipment for photographic equipment. T. O'Connell, Marquette University Physics Dept., Milwaukee, Wis.

WILL SWAP—Have several auto sets old and new, ac and battery sets. I need medium and heavy duty power transformers for ham "rig." Write for list. Glenn C. Diggs, Lake City, S. C.

WANTED — Burned out power xformers or medium or large iron xformer cores, any condition. Send card stating size and what you want. Franklin Nagy, Mary Ella Hall, Kannapolis, N. C.

TRADE—Hallicrafter marine or Vomax for DB-20 pre-selector. Trade microscope 1455X, 4 objectives, 3 occulars, and carrying case for violin or what have you? Percy Ott, 507 Juniper St., Quakertown, Pa.

FOR SALE—Standard brand radios, all types, phono combinations, small appliances, etc., and in sealed cartons. Tell us what you need on your letterhead. Will quote prices. Jack's Radio Service, 111 W. Hoffman Ave., Lindenhurst, L. I.

SALE—2 mtr. converter, to be used with any good communications receiver. Priced at $19.50 net. Bruce Radio, 1171 Union St., Manchester, N. H.

WILL SWAP—One complete set of imported music engraving tools $270. One Sweigard Ideal No. 4 photo engraving printing frame $60, or sell both for $300 cash, or will swap for new condition radio test instruments. Bluebell Garage, Slatington, Pa.

FOR SALE—1900 new miniature tubes, type 1T4. Very reasonable. Feiler Engineering Co., 422 S. Dearborn, Chicago 5, Ill.

FOR SALE—DPDT switches 30 cents. IRC resistors 1 watt 10 cents each, all sizes. Tubes 40% off. Will trade other equipment. Send list. Ed's Radio Service, 2868 Woodhill Rd., Cleveland 4, Ohio.

FOR SALE—Superior model BR-44 resistance capacity bridge. 0 to 100 megohms in 2 ranges and .0001 to 100 mfd in 2 ranges. Contains a signal tracing amplifier and 6E5 indicator tube. Make an offer. M. B. Kempf, 4525 N. Bartlett Ave., Milwaukee 11, Wis.

FOR TRADE — Thordarson transformers 75C58, 13R16, 13R14, 16C07, 75C49, 19F88, 74A31; and six INCCO type "SA" oil filled 10 micro-farad, 600 volt condensers for test equipment of equal value. Need volt-ohm meter and signal generator. D. Hinkle, RFD 1, Amherst, Mass.

FOR SALE OR SWAP—Magazines, record changer and reproducer, roller skates,, ice skates, German type motor generator sets, low impedence phones and mikes, collapsible antennas, text books, 25 cycle power supplies torn down, heavy duty magnovox speaker, Army great coat. Will exchange lists. For complete description write to Research Service, 1518 N. Buchanan St., Arlington, Va.

FOR SALE—2 WE wire recording magazines, including heads, spools, wire level wind, indicators. Needs only amplifier and motor for a complete wire recorder. Perfect condition, one or both at $29.50 each, express collect. M. Goldberg, 333 Hull Ave., Bronx 67, N. Y.

WANTED — September, 1945 QST. Also want the following issues of Radio News: Jan. '41 to Oct. '46 inclusive. Will buy single or in lot. Milton Kalashian, 2 Congress St., Newburyport, Mass.

FOR SALE—German tubes, KDD1, KB2, KC3, KF4, RV12P. 2000 parts from Korting and EZ6 German radios. Want signal tracer and 'scope. John Reed, Reed Radio Repair, Mansfield, Mo.

FOR SALE—Hallicrafters 15 tube receiver, SX-28; 550 kc, 42 mc including matching Hallicrafters-Jensen bass-reflex cabinet with 12" speaker. Excellent electrical and mechanical condition, $220 FOB. Otto Pollei, Jr., 2122 Edgeland Ave., Louisville, Ky.

FOR SALE—30 watt audio amplifier with push-pull expander, crystal throat microphone, condensers, resistors, tubes, transformers, radio books, magazines, and chemical glassware. Low prices. Kenneth Hoffman, RD 2, Flemington, N. J.

FOR SALE OR TRADE—Partially completed BC375E xmitter less tubes, meters and tuning unit, $10. Also BC654A xmitter receiver complete with all tubes, etc., $25. Many other items. Write Frank H. Carlson, New London, Iowa.

FOR SALE OR SWAP—1/3 hp Delta split phase 110v ac, 6v dc vibrapack, 300v dc 100 mils ranging to 175v dc 25 mils. Want test equipment or cash or what have you? Best offer takes either or both. Bronson Potter, Box 371, Concord, N. H.

FOR SALE—1 code oscillator with speaker, place for phones and key. Used 1 month, price $8.50. John S. Hall, 6011 Pearidge Rd., Huntington 2, W. Va.

WILL SELL OR TRADE—Back numbers of several radio magazines 1922-1930. Felix Januss, 511 E. 6th St., Los Angeles 21, Calif.

FOR SALE OR TRADE—3 tube wireless phono oscillator with extra gain stage for crystal mike, $5.00 postpaid. Also Radio Physics course, Modern Radio Servicing, and Radio Trouble Shooter's Handbook, like new, $4 each postpaid. Will swap for phono records in A1 condition. Used records bought. Gerard W. Thibodeau, Central Maine Sanitorium, Fairfield, Me.

FREE—50L6, 35Z5, 12SA7, 12SK7, 12SQ7, all 5 tubes given free with every $25 order. New guaranteed tubes 60%-80% off. 1/2 meg. vol. controls, 2" shaft, SPST switch, 47 cents. 100 resistors, all popular 1/2 watt ohmages, $1.89. Write for free bargain catalog. Globe Distributors, 72 Harvard St., Boston 24, Mass.

FOR SALE OR TRADE—RCA signal generator model 153 in perfect condition, used very little, $42.50 or trade for small communications receiver in good condition. George S. Preston, Hamilton, Va.

FOR SALE—Webster deluxe changer and recorder, plays 17 mixed records, $65. Vomax VTVM, $52. Stand. signal generator, model 78B, 15 to 230 mc, $45. GE LB530X portable extra storage battery and vibrator, $35. McElroy tape recorder, $22. 7" and 5" scope kits, $70 each. Wire recorder, $43. J. Bourke, Box 35, E. Rockaway, N. Y.

SWAP OR SELL—One Hickok model 203, brand new, perfect condition, for one model 900 Vomax and one model 904. Sporna Radio Service, Escatawpa, Ala.

FOR SALE—Portable recording machine made by Radio-Tone, Inc., model HR12 complete ready to go with assortment of blank discs. First offer over $100 takes it. Write for more information. Also have Hallicrafters SX28A receiver in excellent condition, only used a few months. Make an offer. Kurth's Sound Equipment, Hutchinson, Minn.

FOR SALE—Bell rectifiers, 110v ac imput 110v dc output, also 24v dc output, all types of hard to get relays. Battery testers, Allen analyzers, Hickok multimeter, Jackson signal generator, general purpose meters all kinds and styles, less than 1/2 of the net cost. Must close them all out. For details, prices, write to Morris Electric Co., 88a Dartmouth St., Boston 16, Mass.

FOR SALE—New tubes, nearly all numbers including acorn tubes. Also radio parts at 10% discount. New 1947 table model 5 tubes superhet beautiful walnut cabinets, $21 postpaid. Terms cash or 25% cash, balance COD. Snyder's Radio Service, 25 N. Center St., Sunbury, Pa.

FOR SALE—Precision 830 multimeter, $18. Clough-Brengle OCA signal generator, $35. Simpson 325 tube checker, $35. All are used but in excellent condition. All three pieces at $80. First money order gets all, or $10 down and rest COD. Joseph Randazzo, 278 Nassau Rd., Roosevelt, N. Y.

FOR SALE — Solar CE Exameter, RCA 155-C 'scope, and approved A-200 signal generator. All instruments used very little and guaranteed first class shape. Also new and used HO and TT gauge model railroad equipment for sale or swap. All inquiries answered. Ralph H. Ott, Box 21, Glen Mills, Pa.

FOR SALE—New Army type PE-103 dynamotor, 6 or 12 volt input, 500 volts, 160 mills output. Also GN-35 hand driven generator, 300 and filament voltage output. Can be used as a generator, motor or dynamotor. Al McKenna, 65 Corona St., San Francisco 12, Calif.

FOR SALE OR TRADE—McGraw-Hill Practical Electricity, 8 volumes, $15. Will trade for an old model tube tester. Must be in good or repairable condition. Robert Drake, R.R. 1, Hartford City, Ind.

FOR SALE OR TRADE—Considering quitting part time radio business, hours too long. $800 worth of instruments, tubes and parts. One RCP NS802 tube and set checker, 1 Monitor crystaliner, 1 Solar CE160, Meissner analyst, 1 Hickok 288X, all A shape. Consider trade for light airplane or late model car. Will pay difference if your value greater. Vern M. Harris, Boron, Calif.

FOR SALE—24 copies Radio Craft, 1943 to 1946, $2.50 for all. Home Made Radio Test Instruments, Modern Battery Sets, Modern Radio Servicing Technique, Radio Kinks and Short Cuts, $1 for all. Supreme books, Simplified Radio Servicing, Practical Radio Mathematics, both for $1. All in good condition. You pay postage. Chas. W. Belsky, 496 Crestview, San Bernardino, Calif.

FOR SALE OR TRADE—One Hickok model 51X tube tester in excellent condition; 1 tube tester, home built, nearly new; 1 vacuum tube voltmeter and signal tracer, in excellent condition. All inquiries answered. James W. Hoskins, 212 Middlefield Rd., Palo Alto, Calif.

FOR SALE—Modern home in rich Southwestern Oregon town, combined with well established radio repair business. A few Cornell-Dubilier postals will keep you busy. Practically no overhead. 2, lots, garden, furniture, equipment, chickens, everything $7500. Terrill's Radio, Myrtle Point, Ore.

FOR SALE—One Gernsback No. 4 Official Radio Service Manual postpaid, $3.50. J. Goldstein, 151-09 34th Ave., Flushing, Long Island, N. Y.

FOR SALE—RCA model 155C 3" oscilloscope, used 3 times. Uses 2 6SJ7, 1 6C8, 2 5Y3, 906P1, cost $115. Will sell for $89. Calumet Appliance Co., 670 Wentworth Ave., Calumet City, Ill.

FOR SALE OR SWAP—Tank antenna, 8000 volt CT transformer, 100ma, four 705A's, ten 1625's, tubes new, 3 and 4 cable junctions for coax and new Stancor choke C-1405 500ma, 7500v insulation. Al Svirmickas, 7202 S. Fairfield, Chicago 29, Ill.

ATTENTION—Got a penny and a moment to spare? Get on our mailing list now for the best buys. Receive our catalogs and flyers. Send a penny post card with your name and address. State whether ham, dealer, etc. Sarvi Supply, 297 Broadway, Brooklyn 11, N. Y.

FOR SALE OR TRADE—RAK-7 receiver and regulated 110v ac power supply. Tunes 15-600 kc in 6 bands. Has special audio selectivity circuit. In original packing cases. Want speakers, test equipment, war-surplus gear, or $35 cash. Paul V. Ellis, 322 17th St., Astoria, Ore.

FOR SALE—6 complete years of QST, 1930 to 1935, in good condition. Name your price. Also have Univex 8mm camera and projector in A1 condition just returned from factory. Camera has special finding lense, carrying case for projector. First $40 takes the complete set. V. V. Vaught, 114 W. 19th Ave., Pine Bluffs, Ark.

TRADE—Phillips (English) tubes, one each, E447 HF pentode selectode, E462 and E428, one Telefunken RGN 1064 FW Rect. similar to our 80. All serviceable, taken from set playing. No use to me. What am I offered? Want Royal Signet portable typewriter, no other type. All cap keyboard, in good condition. What do you want. Have many radio parts. W3ARM, R.D. 1, Ambler, Pa.

FOR SALE—One Jackson condenser tester model 650A, new, used only a few hours. First $49 money order or certified check takes it. Tony Zimak, 1795 E. 63 St., Cleveland 3, Ohio.

FOR SALE OR SWAP—Latest NRI course including NRI tester for $50 cash or Precision E-200 signal generator or Solar Exam-Eter, CF-60. Frank Wurst Radio Service, 242 Dayton Ave., Clifton, N. J.

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